

# United States Environmental Protection Agency (USEPA)

## Background Study for Santa Susana Field Laboratory (SSFL)

May 12, 2011



# Radiological Background Study Objectives

- ▣ The purpose of the Background Study is to determine the level of “ambient or background” radioactivity found in soil.
- ▣ The Background Study Report will be used in part to assist the State of CA in developing cleanup numbers for the Look-Up Tables as required by the Administrative Order on Consent (AOC). DOE, NASA and DTSC are parties to this AOC.



# Project Schedule

Activity	Planned Date
Data Validation	Complete
Technical Memorandum Addendum	Complete
Draft Background Study Report	July 2011



# Agenda

1. Summarize Technical Memorandum Addendum and its Purpose
2. Overview of Next Steps for Completion of Background Study Report and Development of Look-Up Table
3. Summarize Steps to Develop Background Threshold Values (BTVs)
4. Summarize Statistical Approaches Discussed and Recommended at Last Meeting
5. Present Statistical Evaluation of Select Radionuclides
6. Stakeholder Issues
7. Management Decisions impacting Look-Up Table Values
8. Schedule and Upcoming Meetings



# Technical Memorandum Addendum Overview

- ▣ The purpose of the technical memorandum addendum is to present the laboratory results not included in the technical memorandum previously submitted in February 2011.
- ▣ A comprehensive background study report is being prepared and will be distributed. The report will contain statistical evaluations of all data. BTVs will be presented for each radionuclide. Ultimately, the BTVs will be used to assist the State of California in making cleanup decisions at the SSFL.



# Background Study Report and Look-Up Tables

- ▣ Background Study Report
  - Issue Draft Report
  - Public Comment
  - Community Meeting
  - Finalize Report
- ▣ Development of Look-Up Tables
  - Look-Up Table values will be based on BTVs, but will incorporate management decisions to facilitate cleanup
  - EPA/DTSC will work together
  - EPA/DTSC will hold joint meetings with stakeholders



# Develop Background Threshold Values (BTVs)

## Comparison of RBRAs to DTLs

- ▣ Look at data distribution and identify outliers.
- ▣ In order to determine if the RBRAs are representative of “Background” soils, the analytical data from the RBRAs will be compared to the analytical data from the DTLs.
- ▣ If the analytical data from the RBRAs are comparable to the analytical data from the DTLs, then the RBRAs can be considered “Background Locations”.



# Develop BTVs

## Determining if Individual Data Sets can be Merged

- ▣ There are six individual data sets.
  1. **Lang Ranch**
    - Surface and subsurface
  2. **Rocky Peak**
    - Surface and subsurface
  3. **Bridle Path**
    - Surface and subsurface
- ▣ EPA will statistically compare all these data sets to each other to determine if they are similar enough to be merged together.





# Determining Specific BTVs and Final Application

- ▣ Once EPA has determined the applicable data sets, BTVs will be calculated. There may be as many as 6 BTVs per analyte if data sets cannot be merged.
- ▣ Choose the best statistic to represent the BTV
- ▣ Requirements of the AOC
  - Develop a Look-Up Table based on BTVs and practical application.
  - No averaging.
  - Compare individual discrete samples.



# Statistical Approach

- ▣ EPA generally uses 95% statistics for background data sets because clean up decisions are made based
  - Risk assessments; and
  - Distribution of contaminants
  
- ▣ EPA recommends using the 95% Upper Simultaneous Limit (USL95) to determine BTVs for SSFL because:
  - Significant research was done in order to choose appropriate background locations;
  - The analytical data is very consistent; and
  - There are few outliers in the analytical data which are not being included in the statistical evaluation.



# Recommended Statistical Approach (see Handout)

## 95% Upper Simultaneous Limit (USL95)

- An USL95 based upon an established background data set represents an estimate such that all observations in the data set are less than or equal to the USL95 with 95% confidence coefficient.
- A USL95 can be used when many and/or unknown number of future onsite observations need to be compared with BTV.
- USLs take variability into account.



# Summary of the Major Analyte Classifications from the Background Study Data

1. Radionuclides with less than 5 detections
2. Radionuclides with greater or equal to 5 detections
  - Radionuclides with one BTV from combined data
  - Radionuclides Exhibiting Differences Between Surface Soil and Subsurface Soil
  - Radionuclides Exhibiting Variability Between RBRAs
3. Rejected Results



# Radionuclides with Less than 5 Detections

- Ten (10) radionuclides exhibited fewer than 5 detections in the background study samples.
- Due to the low number of detections, any statistical evaluation of the data of these radionuclides is suspect.
- EPA recommends that the maximum value between the Agricultural  $10^{-6}$  Preliminary Remediation Goal (PRG) and the maximum non-detect (ND) for each radionuclide be used as the BTV.

Radionuclide	Maximum ND (pCi/g)	Agricultural $10^{-6}$ PRG (pCi/g)	BTV (pCi/g)
Cobalt-60	5.56E-03	9.01E-04	5.56E-03



# Radionuclides with Greater than or Equal to 5 Detections

- ▣ Fifty-four (54) radionuclides analyzed for the SSFL Background Study exhibited greater than or equal to 5 detections.
- ▣ We recommend calculating BTVs based on the 95% Upper Simultaneous Limit (USL95).



# Radionuclides with only one BTV

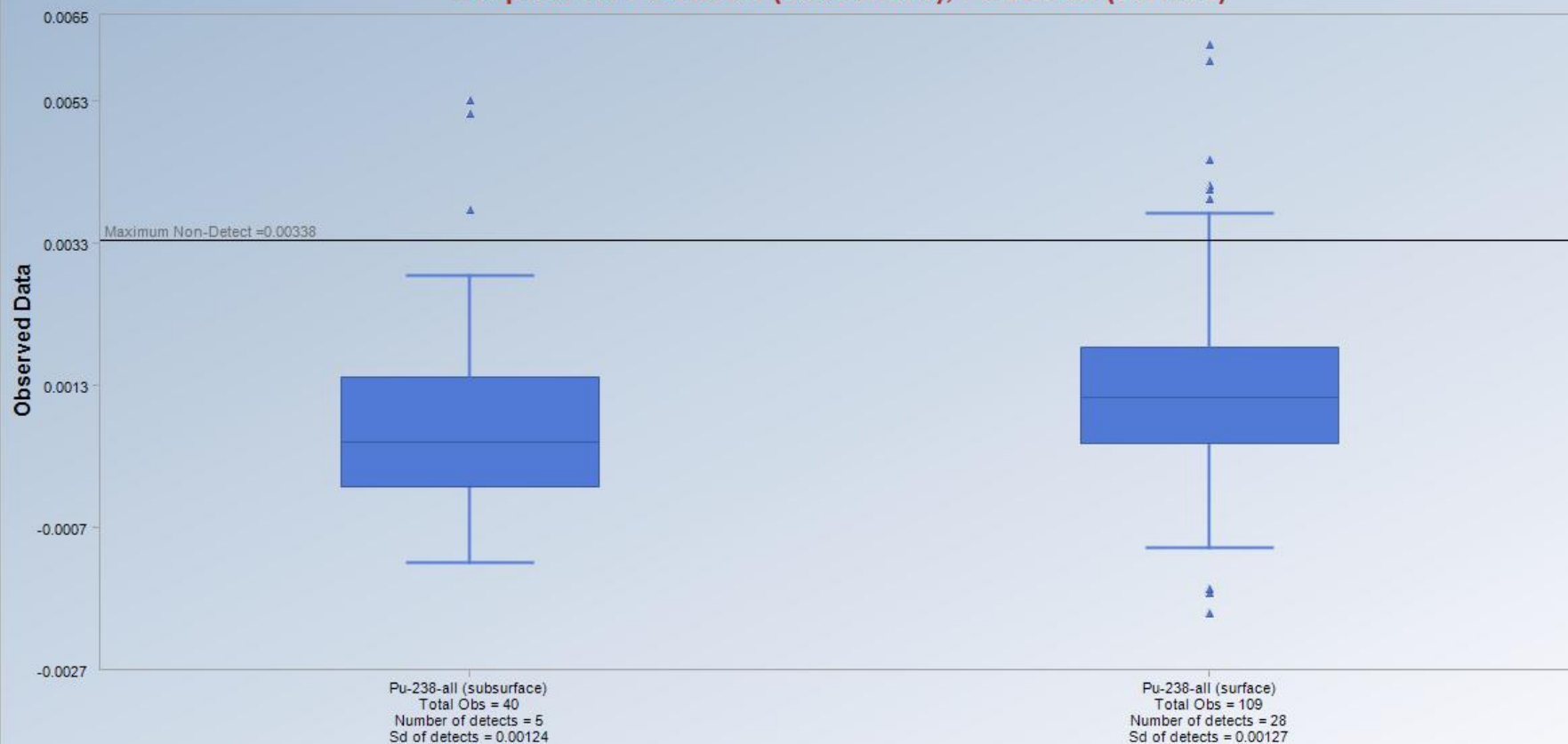
- ▣ Some analytes exhibited results that were statistically the same between strata.
- ▣ In these instances, all the analytical data were combined to calculate one BTV.
- ▣ One example is plutonium-238.



# Plutonium-238

## Subsurface Soil vs. Surface Soil Samples

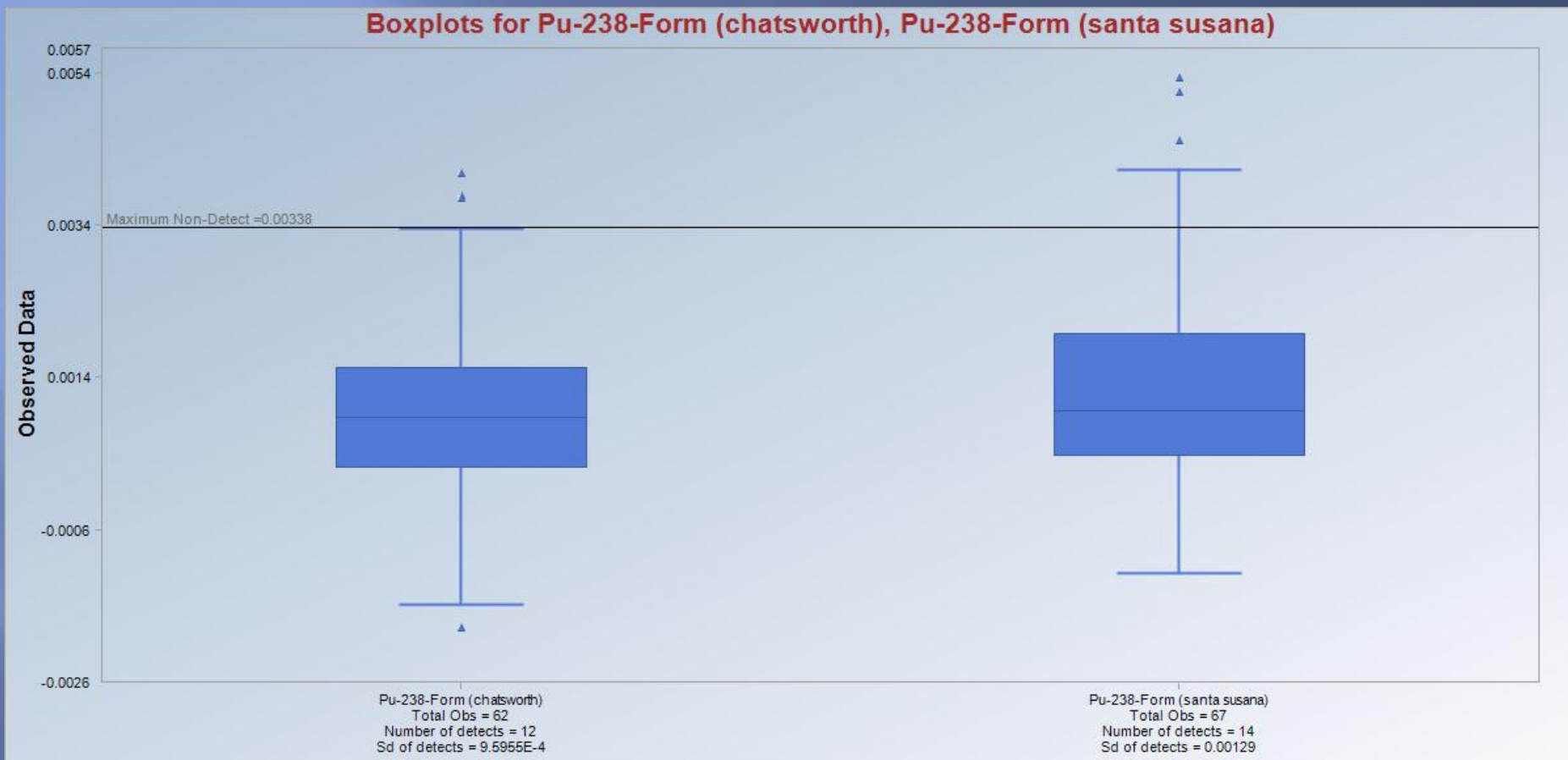
Boxplots for Pu-238-all (subsurface), Pu-238-all (surface)





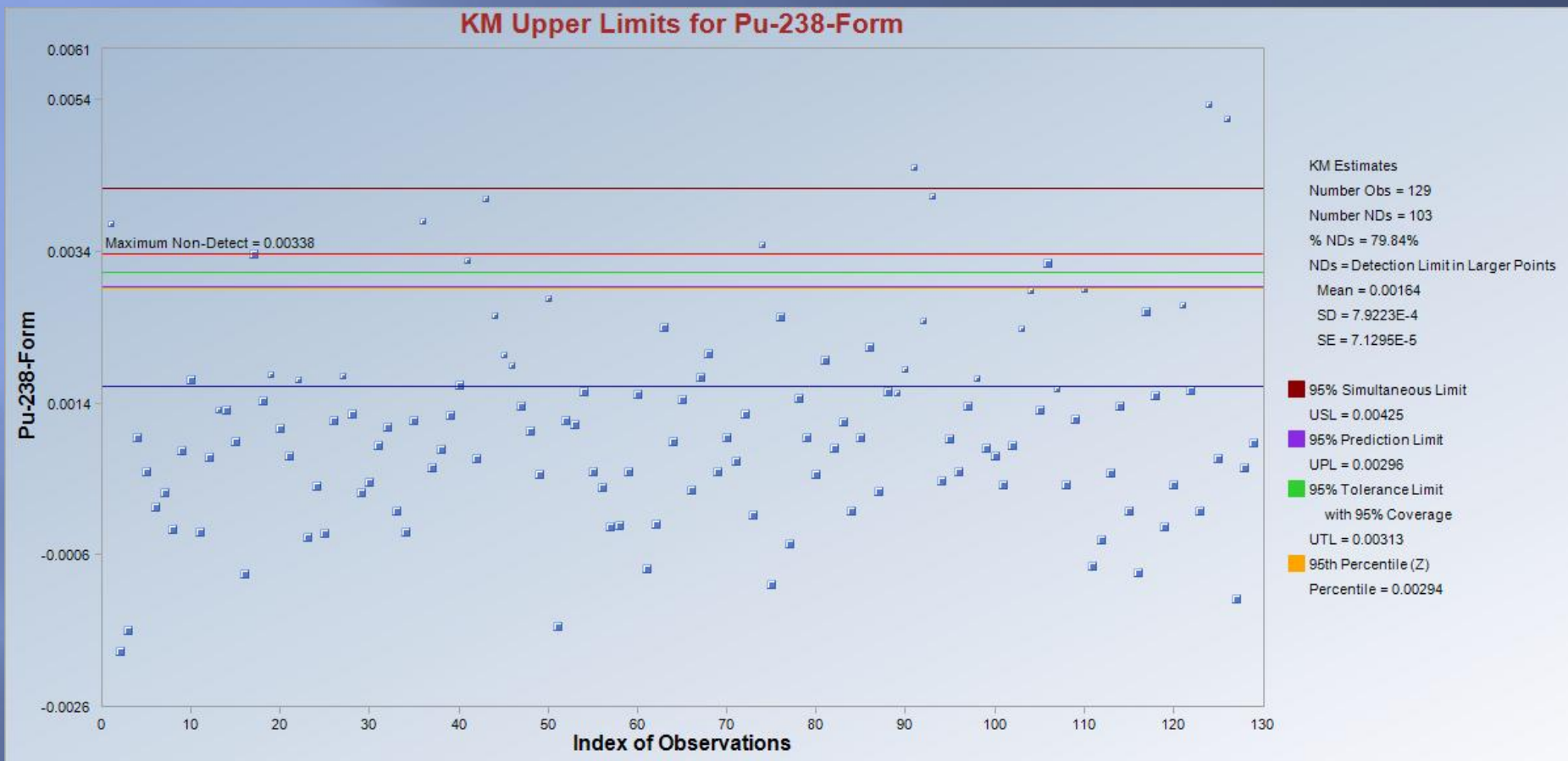
# Plutonium-238

## Chatsworth Formation vs. Santa Susana Formation



# Plutonium-238

## BTV Estimates for Pu-238 Activity in All Strata



**USL95 = 0.00425 < PRG = 0.00731**

**UTL95 = 0.00313**

**UPL95 = 0.00296**



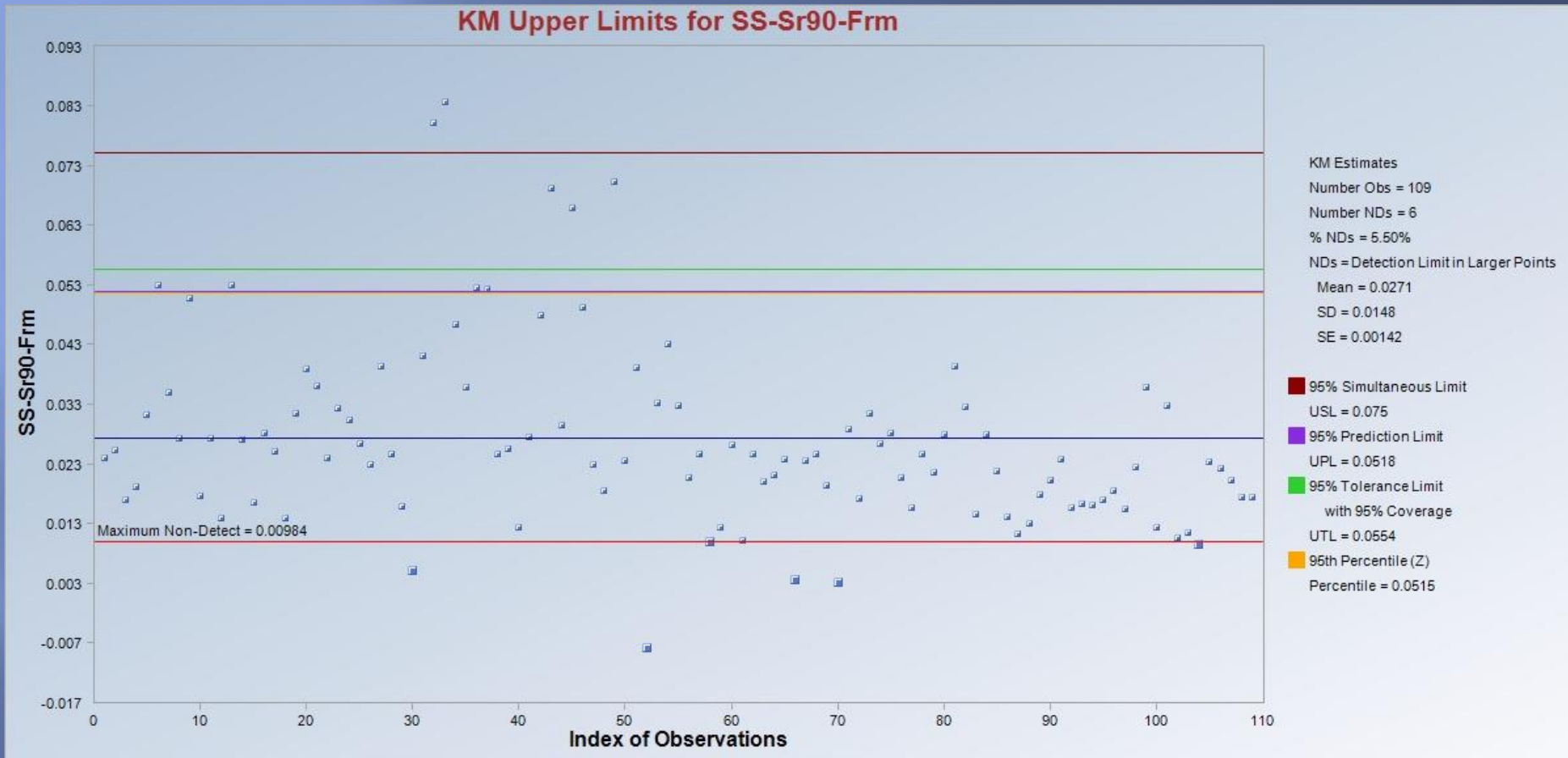
# Radionuclides exhibiting Differences between Surface and Subsurface Soils

- ❑ Some analytes showed differences between surface and subsurface soils.
- ❑ Therefore, separate BTVs were determined for surface and subsurface soils.
- ❑ Two examples are strontium-90 and cesium-137.



# Strontium-90

## BTV Estimates for Sr-90 Activity in Surface Soils



**USL95 = 0.075 > PRG = 0.00139**

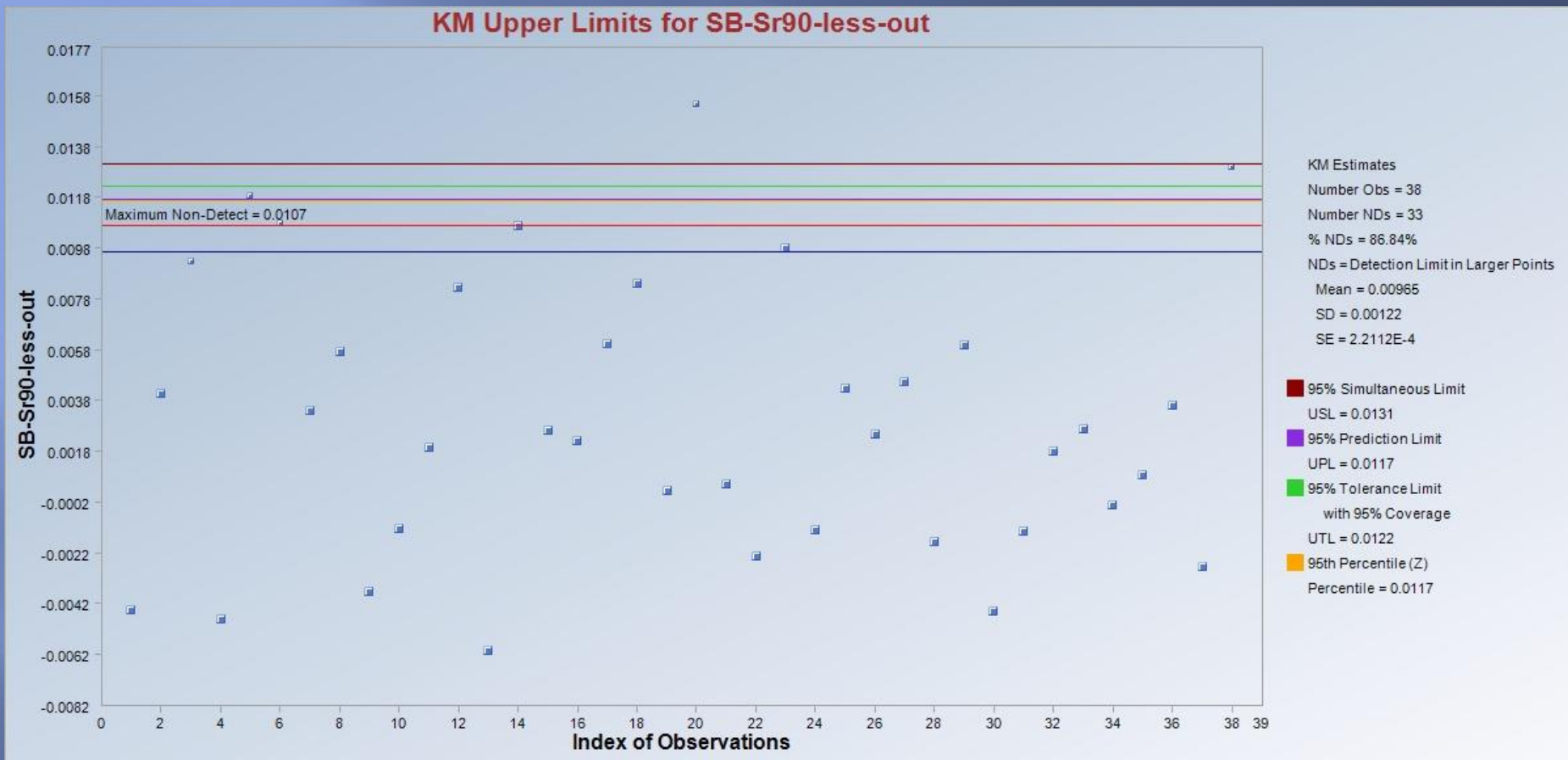
**UTL95 = 0.0554**

**UPL95 = 0.0518**



# Strontium-90

## BTV Estimates for Sr-90 Activity in Subsurface Soils



**USL95 = 0.0131 > PRG = 0.00139**

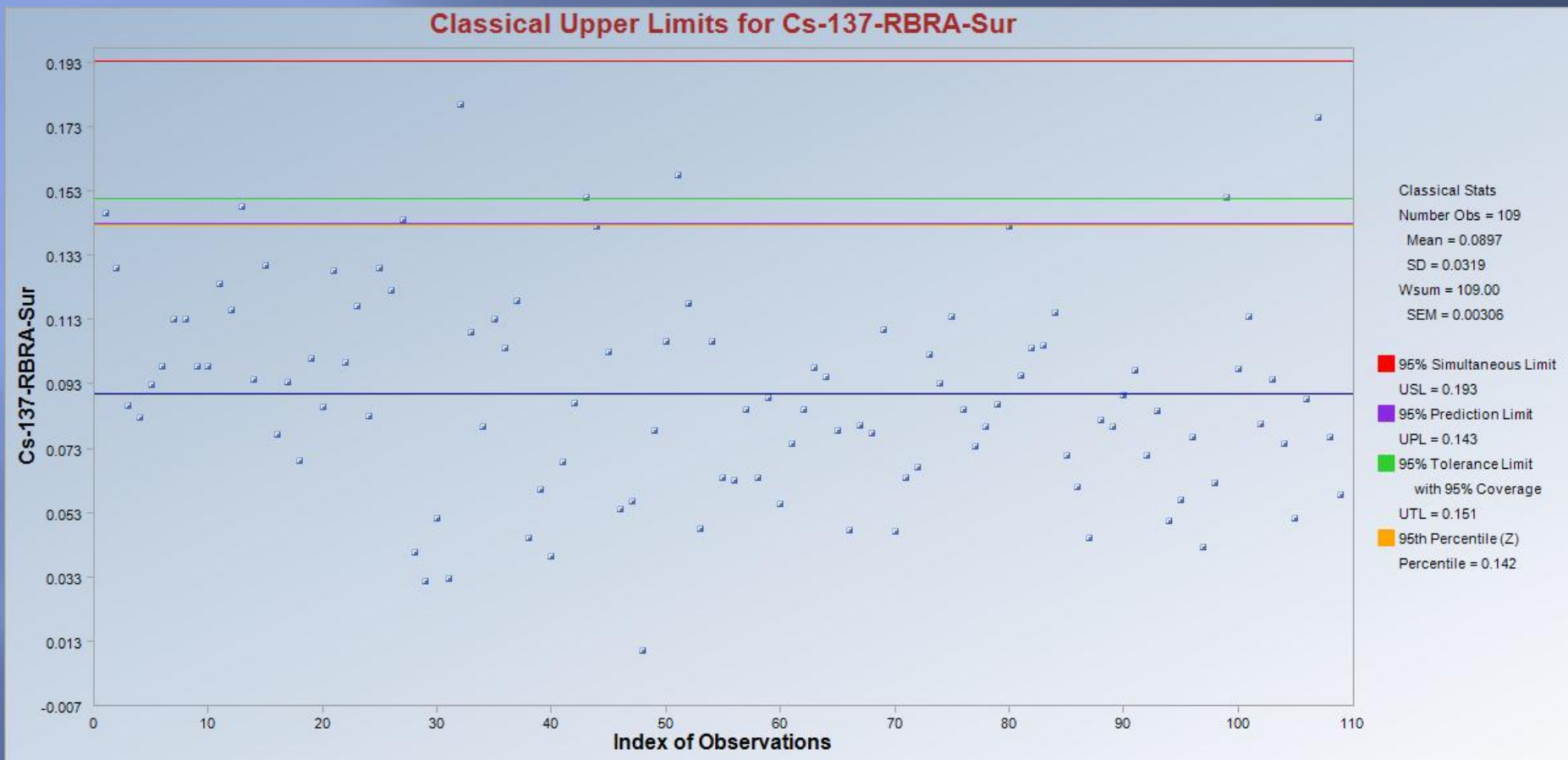
**UTL95 = 0.0122**

**UPL95 = 0.0117**



# Cesium-137

## BTV Estimates for Cs-137 Activity in Surface Soils



**USL95 = 0.193 > PRG = 0.0012**

**UTL95 = 0.151**

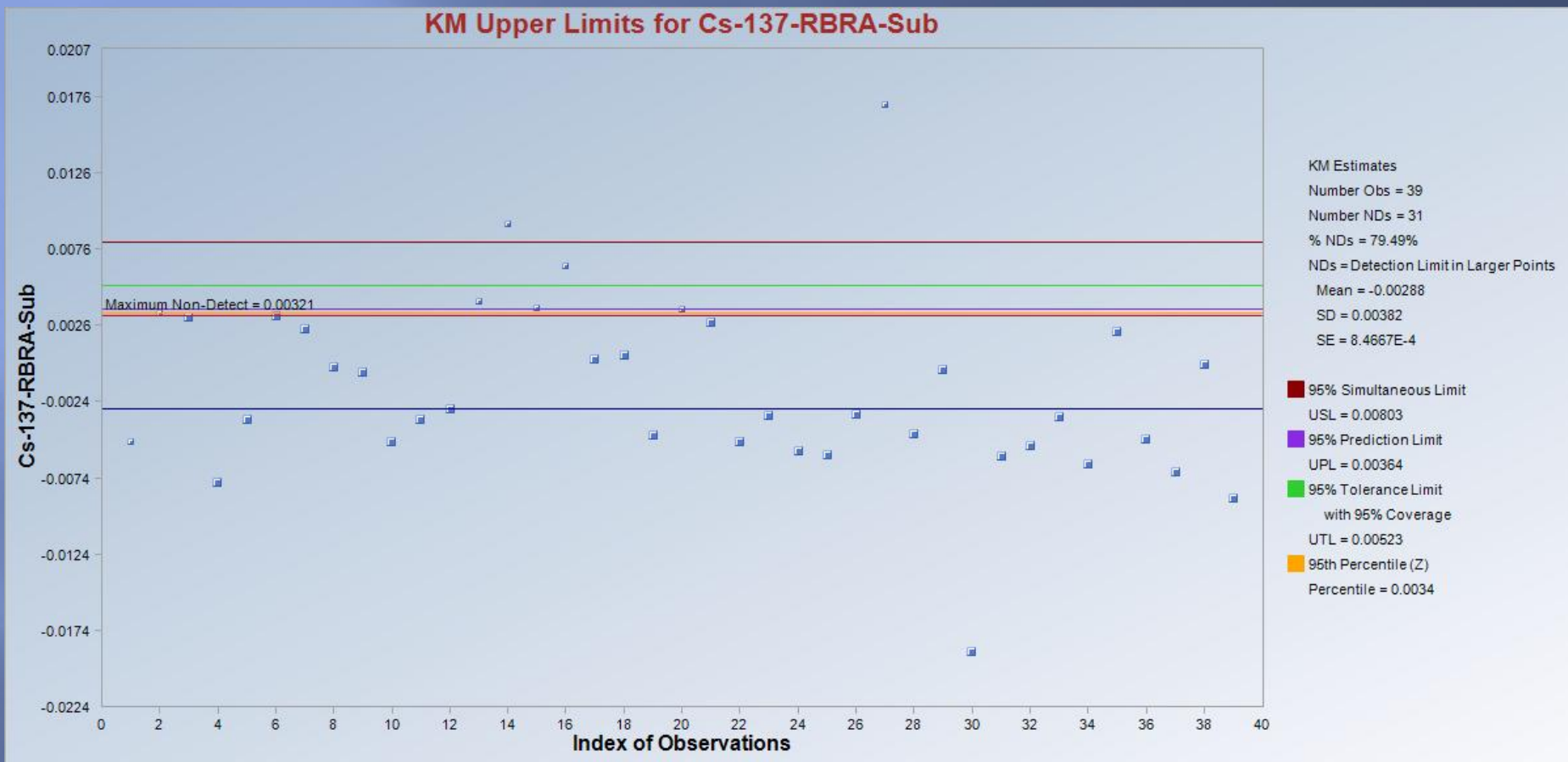
**UPL95 = 0.143**





# Cesium-137

## BTV Estimates for Cs-137 Activity in Subsurface Soils



**USL95 = 0.00803 > PRG = 0.0012**

**UTL95 = 0.00523**

**UPL95 = 0.00364**



# Radionuclides exhibiting variable results between RBRAs

- ▣ Some radionuclide analytical results exhibited variability in results between RBRAs.
- ▣ EPA believes this variability is due to natural differences in the soil and rock types at each RBRA.
- ▣ One example is radium-226.

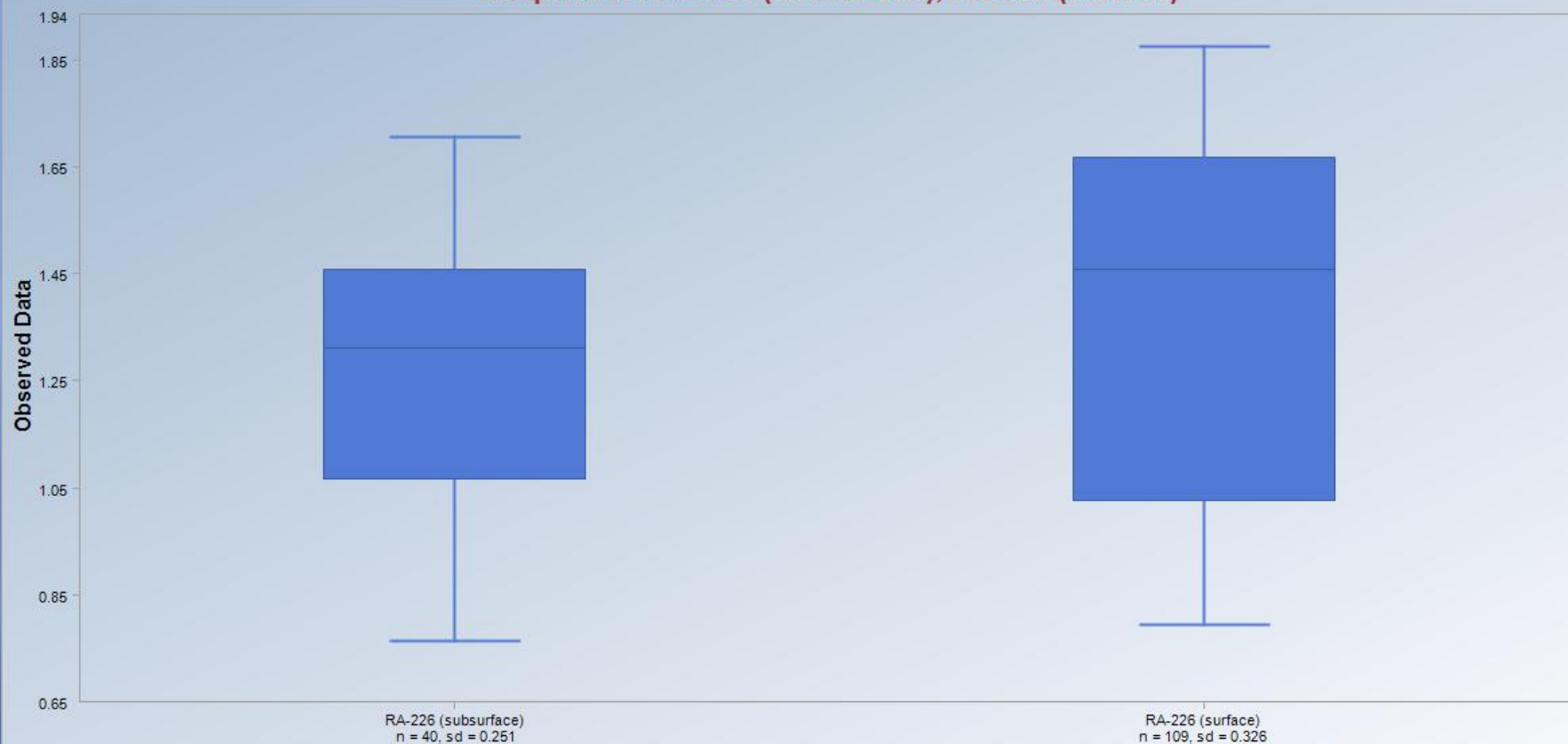




# Radium-226

## Subsurface vs. Surface

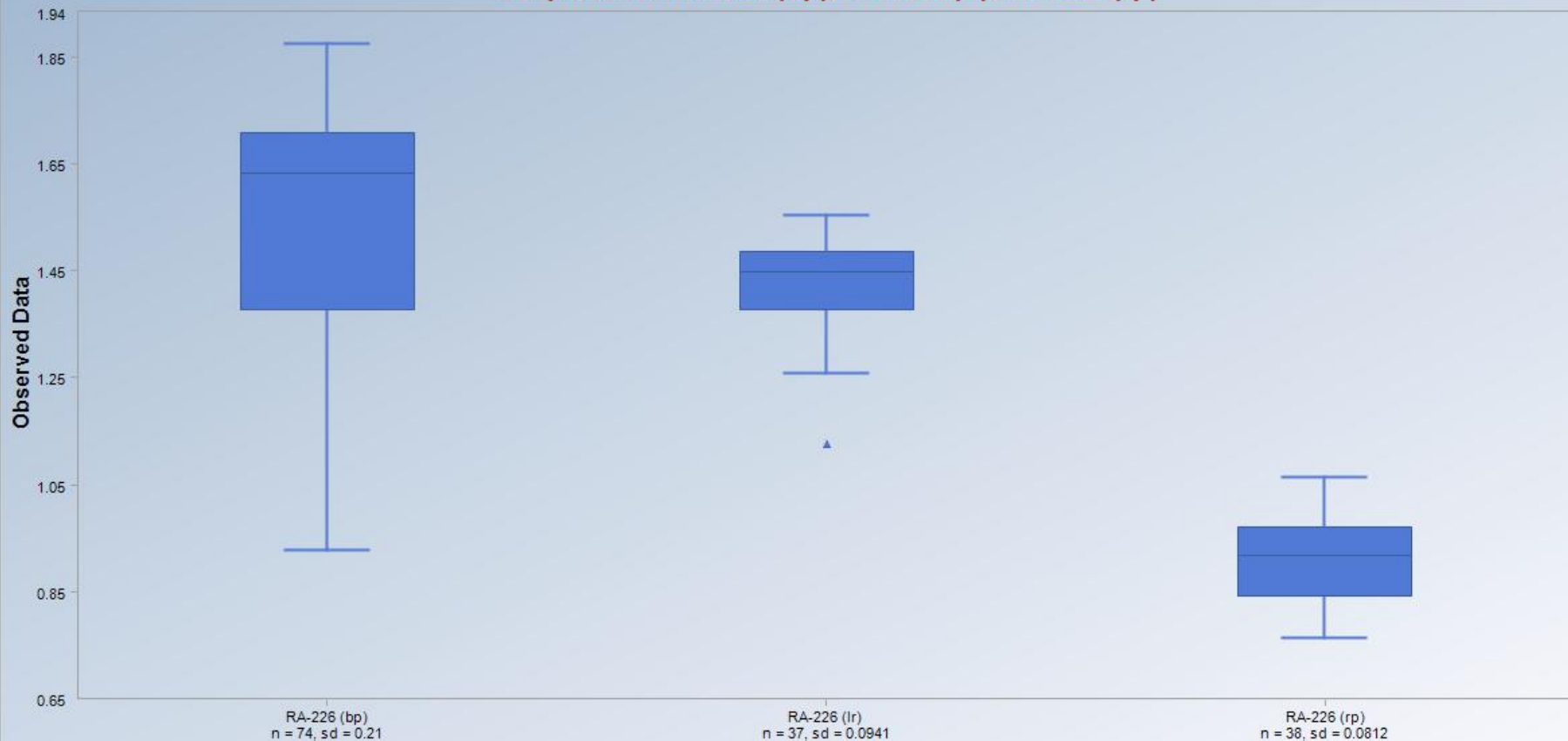
Boxplots for RA-226 (subsurface), RA-226 (surface)



# Radium-226

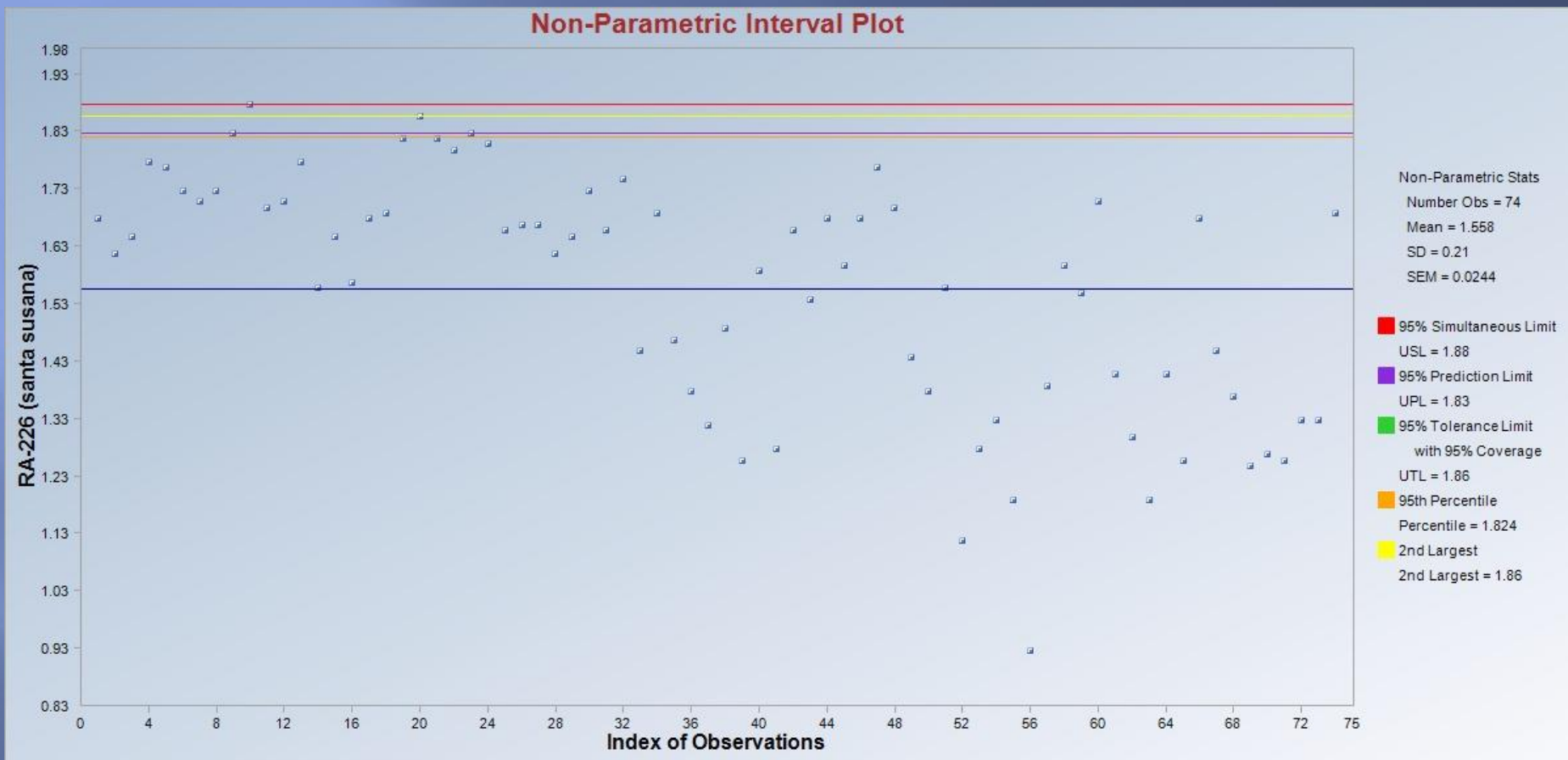
## Comparison of RBRAs

Boxplots for RA-226 (bp), RA-226 (lr), RA-226 (rp)



# Radium-226

## BTV Estimates for Ra-226 Activity at the Bridle Path RBRA



**USL95 = 1.88 > PRG = 0.000632**

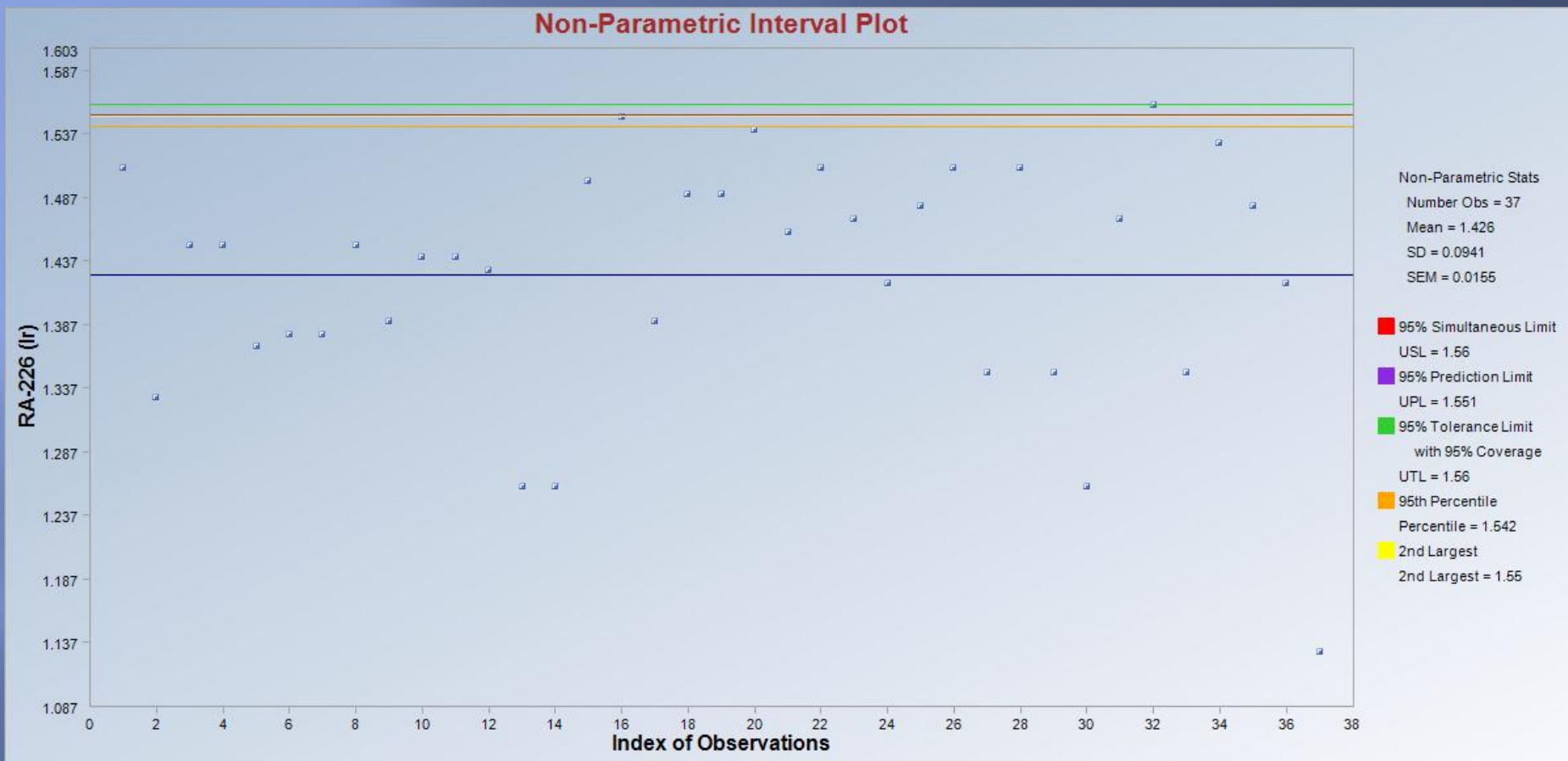
**UTL95 = 1.86**

**UPL95 = 1.83**



# Radium-226

## BTV Estimates for Ra-226 Activity at the Lang Ranch RBRA



**USL95 = 1.56 > PRG = 0.000632**

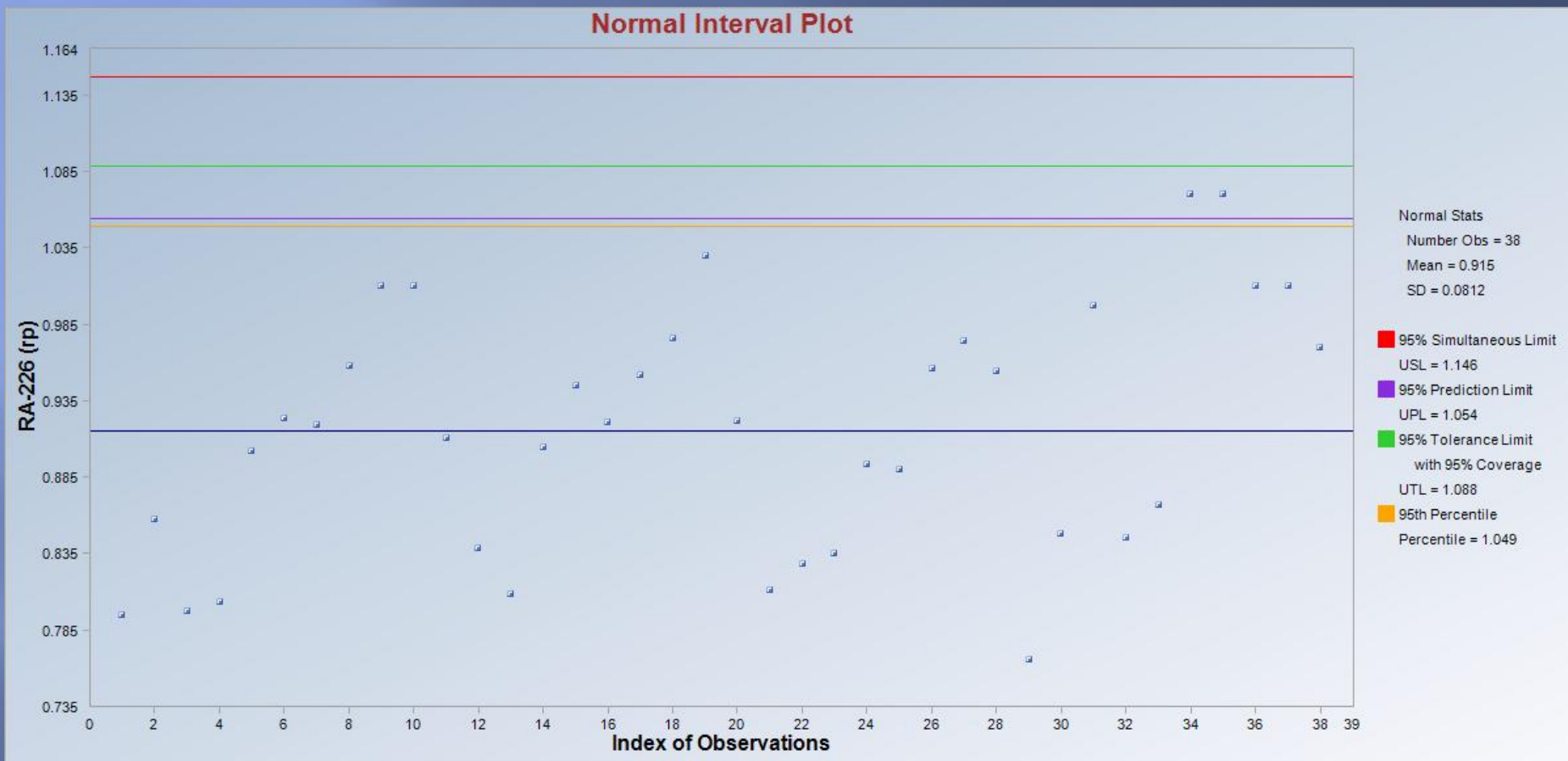
**UTL95 = 1.56**

**UPL95 = 1.551**



# Radium-226

## BTV Estimates for Ra-226 Activity at the Rocky Peak RBRA



**USL95 = 1.146 > PRG = 0.000632**

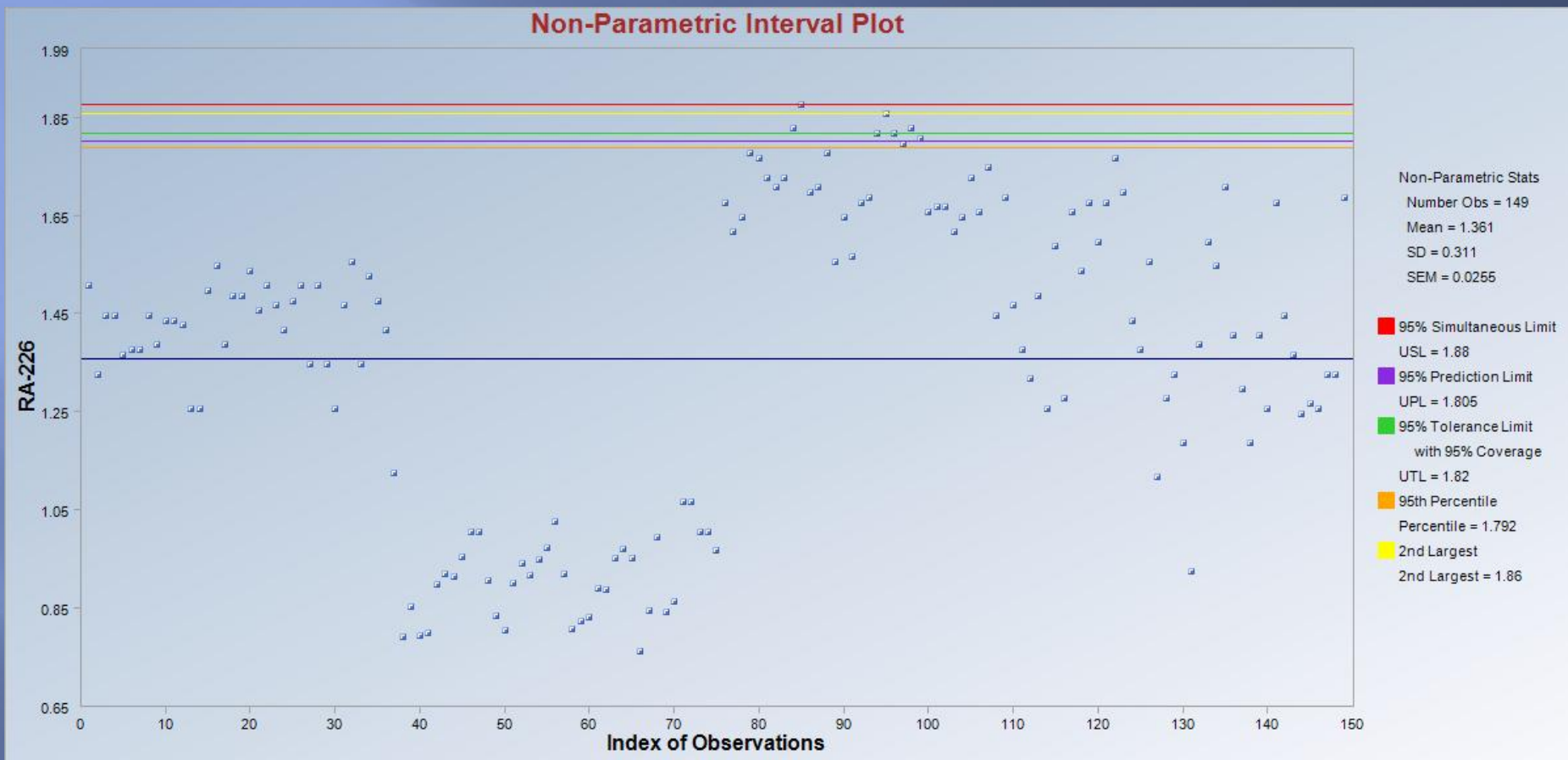
**UTL95 = 1.088**

**UPL95 = 1.054**



# Radium-226

## BTV Estimates for Ra-226 Activity in All Strata



**USL95 = 1.88 > PRG = 0.000632**

**UTL95 = 1.82**

**UPL95 = 1.805**



# Spectral Interference

- ▣ The gamma spectroscopy results for barium-133, californium-249, silver-108, and silver-108m have been rejected due to spectral interference from naturally occurring radionuclides, which were observed in all the samples.
- ▣ EPA believes these radionuclides are not of concern at the SSFL.
- ▣ If these radionuclides become an issue onsite, the archive samples will be reanalyzed.



# Stakeholder Issues

- ▣ Dan Hirsch
- ▣ Abe Weitzberg







# Development of Look-Up Values

1. USLs Greater than Maximum Detection
2. PRGs Greater than USL(s) or Maximum Detection
3. Use of only the Surface Soil BTV for Soil Cleanup Values
4. Determining Cleanup Values when BTVs are different between RBRAs



# USLs Greater than Maximum Detection

- ▣ Some radionuclides (i.e., cesium-137) exhibit USLs greater than the maximum detection.
- ▣ In these instances the statistical evaluation is predicting that if more samples were collected and analyzed from the same area, the analytical results of those additional samples would exhibit higher concentrations than our current data set.
- ▣ This prediction is based on the variability of the available data.



# PRGs Greater than USL(s) and Maximum Detection

- ▣ Some radionuclides (i.e., plutonium-238) have Agricultural  $10^{-6}$  PRGs that are greater than the calculated USL(s) and the maximum detection.
- ▣ In these instances, EPA may recommend that the Agricultural  $10^{-6}$  PRG be used as the Cleanup Value in the Look-Up Table.



# Use of only the Surface Soil BTV for Soil Cleanup Values

- Because of the soil disturbances that have occurred at the SSFL (construction, demolition, remediation, etc.), it may be difficult to distinguish surface soil from subsurface soil.
- Therefore, EPA may recommend that only the Surface Soil BTV be used as the Cleanup Value in the Look-Up Table.



# Determining Cleanup Values when BTVs are Different Between RBRA

- ▣ Some radionuclides (i.e., radium-226) exhibit different BTVs for each RBRA.
- ▣ EPA believes this variability is due to natural differences in the soil and rock types at each RBRA.
- ▣ Because we are confident that all RBRA locations represent “background” conditions, EPA may recommend that one BTV be calculated using all the data or the highest BTV be used as the Cleanup Value.



# Schedule and Upcoming Meetings

- ▣ Issue Draft Background Study Report for review and comment
  - Report will contain BTV values
  - The report will discuss the practical issues that may be encountered when making recommendations for the Look-Up Table
- ▣ Community Meeting
- ▣ EPA's recommendations for the Look-Up Table will be submitted to the State of California

